PHYS 462/662 | Thermal and Statistical Physics | **Fall 2016**

Course #19325-19326 (3 credits)

Instructor: Dr. Alan R. Denton   alan.denton@ndsu.edu
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Classes: Tuesday & Thursday, 3:30-4:45 p.m., SE 221

Office Hours: Tuesday & Thursday, 1:30-2:45 p.m., SE 214

Bulletin Description:

Classical postulates and laws of thermodynamics; cyclic processes and entropy; thermodynamic potentials, equilibrium, stability, and phase transitions; Maxwell-Boltzmann distribution, applications to classical gases and magnets; quantum statistics, Bose-Einstein and Fermi-Dirac distributions, applications to quantum gases.

Objectives: The objectives of the course are to master the foundations of thermodynamics and statistical mechanics and to apply theoretical and computational methods to solving practical problems in a variety of physical systems. *Graduate students will engage in research on a topic of relevance to both the course and their own research interests.*

Preparation: Basic knowledge of mechanics, quantum physics, mathematical methods.

Student Responsibilities: Attend all classes. Read assigned material in advance. Come prepared for discussion. Be curious; ask questions. Complete assignments on time.

Textbooks: D. Schroeder, *An Introduction to Thermal Physics* (Addison-Wesley, 2000)
               F. Reif, *Fundamentals of Statistical and Thermal Physics* (Waveland, 2008)
               See also the list of Supplemental References.

Evaluation:

Homework	100 pts	
Exams (3)	175 pts	(50+50+75)
Reading quizzes	25 pts	
Project (graduate students only)	50 pts	
Total	300/350 pts	

Requirements and assessment of the project are described in the attached document.

No makeup exams will be scheduled, but your lowest of two midterm scores is dropped.

According to NDSU Policy 333 (`www.ndsu.edu/fileadmin/policy/333.pdf`), attendance in classes is expected. *More than three unexcused absences may result in failure.*

Homework: Assignments will be posted on Blackboard (`https://bb.ndsu.nodak.edu`). While discussion of homework with classmates is encouraged, submitted work must be your own. Similarity to work of other students or to internet solutions will yield no points. Since solutions will be discussed on the due date, *late assignments cannot be accepted.* However, partial credit may be given for incomplete work, so submit whatever you can by the deadline. Note: As part of each assignment, you may be asked to present in class.

Note: Three missed homework assignments will result in automatic failure of the course.

Grading: A: > 90%, B: 80 to < 90%, C: 70 to < 80%, D: 60 to < 70%, F: < 60%

I reserve the right to shift grade boundaries, but any shift will work only in your favor.

Preliminary Schedule

Week	Topics	Reading*
1	Thermodynamical systems and postulates	S1, R2
2	Heat, work, energy, and the First Law of Thermodynamics	S1, R4
3	States, entropy, and the Second Law of Thermodynamics	S2-S3
4	Cyclic processes and thermal engines	S3-S4
5	Equilibrium and stability	S5, R3, R8
5	**Practice Exam: Sept. 22**	S1-S4
6	Ideal and nonideal gases, equations of state	S5, R5
7	Phase transitions and critical phenomena	S5
7	**Midterm Exam: Oct. 4**	S1-S4
8	Legendre transformations and thermodynamic potentials	S5
9	Basics of probability and statistics	R1
10	Microstates, macrostates, ensembles, Second Law	R2-R5
11	Phase space and ensembles	R2, R6
12	Classical Statistics: Maxwell-Boltzmann distribution	S6, R7
13	Applications: ideal gases, paramagnets, and ferromagnets	S6, R7
13	**Midterm Exam: Nov. 15**	S1-S6
14	Quantum Statistics: Bose-Einstein and Fermi-Dirac distributions	S7, R9
15	Applications: quantum gases, blackbody radiation, solids	S7, R9
16	Systems of interacting particles	S8
17	**Final Exam: Dec. 8**	S1-S8

* S=Schroeder, R=Reif